



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/625,256

07/23/2003

Toshiya Yokogawa

5077-73COA

9310

27572

7590

12/27/2004

HARNESS, DICKEY & PIERCE, P.L.C.

P.O. BOX 828

BLOOMFIELD HILLS, MI 48303

EXAMINER

CAO, PHAT X

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 12/27/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/625,256	YOKOGAWA ET AL.	
	Examiner	Art Unit	
	Phat X. Cao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 November 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 13-22 is/are pending in the application.
- 4a) Of the above claim(s) 20 and 21 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 13-19 and 22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☒ Certified copies of the priority documents have been received in Application No. 09/980,598.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>7/2003&12/2003</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Species III in the reply filed on 11/12/04 is acknowledged.

Specification

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 112

3. Claim 14 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 14, the limitations of having a peak which is the largest concentration of the carriers and provided in the first semiconductor layers, and having the valley which is the smallest concentration of carriers and provided in the second semiconductor layers are not supported in the original disclosure. For example, Fig. 5(a) of the present invention shows that a peak which is the largest concentration of the carriers is provided in the second semiconductor layers (delta doped layers), but not the first semiconductor layers (undoped layers) as claimed. Therefore, for the examination purpose, the examiner assumes that a peak which is the largest concentration of the carriers is provided in the second semiconductor layers (delta doped layers), and the valley which

Art Unit: 2814

is the smallest concentration of carriers is provided in the first semiconductor layers (undoped layers).

Double Patenting

4. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

5. Claims 13-18 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 2 of U.S. Patent No. 6,690,035. Although the conflicting claims are not identical, they are not patentably distinct from each other because both U.S. Patent and instant application claim the active region of a semiconductor device configured by alternately layering, comprising: first semiconductor layers provided in plurality which function as a carrier transit region and second semiconductor layers, which are composed of delta doped layers provided in plurality, which include a higher concentration of impurities for carriers than the first semiconductor layers, and which have a thinner film thickness than the first semiconductor layers. Moreover, the claims in the instant application are either broader versions of the claim in U.S. patent No. 6,690,035 or are obvious variations thereof. For

Art Unit: 2814

example, claim 2 in U.S. Patent recites "wherein each of the first semiconductor layers has the same thickness ..., and wherein the thickness of one of said first semiconductor layers is at least about 10 nm and at most about 100 nm," whereas claim 13 in the instant application claims "wherein each of the first semiconductor layers has the same thickness within a range between 10 nm and 100 nm." That shows no different meaning between these two elements. The fact is that the claims of the instant application have claimed the same goal and are not distinguished from each other.

Regarding claims 14-16, because the alternately layering of the semiconductor layers of U.S. Patent are formed the active region and because the second semiconductor layers having a higher concentration of impurities for carriers than the first semiconductor layers (see claim 2), the carriers would exist not only in the first semiconductor layers but also in the second semiconductor layers and the peak of the carriers would be provided in the heavier doped second semiconductor layers.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 13-17, 19 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP (05-013446) – cited by Applicant.

Regarding claims 13 and 17, JP('446) discloses a semiconductor device (Fig. 1)

Art Unit: 2814

made by providing on a substrate 11 an active region that functions as a portion of an active element (transistor), wherein the active region is configured by alternately layering 14/15: first semiconductor layers 14 provided in plurality which function as a carrier transit region, and second semiconductor layers 15, which are composed of delta doped layers (par. [0013]) provided in plurality, which include a higher concentration of impurities for carriers than the first semiconductor layers 14 of I-GaAs (par. [0014]), wherein the first semiconductor layers 14 and the second semiconductor layers 15 are made of the same material of GaAs (par. [0014]), wherein each of the first semiconductor layers 14 has the same thickness within a range between 6 nm and 100 nm (par. [0014] and par. [0023]), and wherein the concentration of impurities for carriers included in the second semiconductor layers 15 is substantially constant (par. [0014]).

JP ('446) does not disclose that the second semiconductor layers 15 having a thinner film thickness than the first semiconductor layers 14.

However, JP('446) further teaches that the spacing between the second semiconductor layers 15 or the thickness of the first semiconductor layer 14 formed between the second semiconductor layers 15 can be set in a range of 6 nm to 100 nm (par. [0023]). Accordingly, it would have been obvious to form the second semiconductor layers 15 having a thinner film thickness than the first semiconductor layers 14 by varying the thickness of the first semiconductor layers 14 in a range of 6 nm to 100 nm because it is expectable that the same effectiveness would be resulted (see par. [0023]).

Regarding claims 14-16, because the alternately layering of the first and second semiconductor layers are formed the active region and because the second semiconductor layers having a higher concentration of impurities for carriers than the first semiconductor layer, the carriers would exist not only in the first semiconductor layers but also in the second semiconductor layers and the peak of the carriers would be provided in the heavier doped second semiconductor layers 15.

Regarding claim 22, JP('446) further discloses that two third semiconductor layers 221/222 are provided on the active region and sandwich the Schottky gate electrode 21, and include a high concentration of impurities (n+), and wherein the source and drain electrodes 23/24 are in ohmic contact with the third semiconductor layers 221/222.

Regarding claim 19, it would have been obvious to form the concentration of impurities for carriers in the first and second semiconductor layers in the range as claimed because the concentration of impurities for carriers in the first and second semiconductor layers are not critical, they can be optimized during the routine experimentation depending upon the time which is set for the doping process. It has been held that where the general conditions of a claim are disclosed in the prior art and absent evidence of disclosure of criticality for the range giving unexpected results, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

8. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP(05-013446) in view of Applicant's admitted prior art.

JP('446) does not disclose the first and second semiconductor layers are made of SiC.

However, Applicant's admitted prior art (Fig. 11) teaches the forming of the first and second semiconductor layers 101/102 of SiC (also see page 2 of specification). Accordingly, it would have been obvious to form the first and second semiconductor layers with either GaAs or SiC because as taught by Applicant's admitted prior art, both GaAs and SiC would have a large band gap and operate at high temperature for utilizing their high withstand voltages (see page 1 of specification).

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is (571) 272-1703. The examiner can normally be reached on Monday - Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

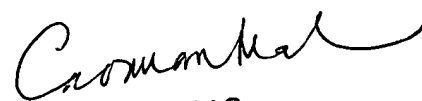
Application/Control Number: 10/625,256

Page 8

Art Unit: 2814

PC

December 16, 2004

A handwritten signature in black ink, appearing to read "Phat X. Cao", written in a cursive style.

PHAT X. CAO
PRIMARY EXAMINER